

**A METHOD FOR RECOVERING 3D SCENE STRUCTURE AND CAMERA
MOTION DIRECTLY FROM IMAGE INTENSITIES**

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ABSTRACT OF THE INVENTION

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10 The present invention is directed to a method for recovering 3D scene structure and camera motion from image data obtained from a multi-image sequence, wherein a reference image of the sequence is taken by a camera at a reference perspective and one or more successive images of the sequence are taken at one or more successive different perspectives by translating and/or rotating the camera, the method comprising

15 The steps of determining image data shifts for each successive image with respect to the reference image; the shifts being derived from the camera translation and/or rotation from the reference perspective to the successive different perspectives;

constructing a shift data matrix that incorporates the image data shifts for each image;

calculating a rank-1 factorizations from the shift data matrix using SVD, with one of the rank-1 factors being a vector corresponding to the 3D structure and the other rank-1

20 factor being a vector corresponding to the size of the camera motions; dividing the successive images into smoothing windows; recovering the direction of camera motion from the first vector corresponding to the 3D structure by solving a linear equation; and recovering the 3D structure by solving a linear equation using the recovered camera motion. In accordance with the present invention, the method includes computing a first

25 projection matrix; recovering camera rotation vectors from the shift data matrix, and the first projection matrix; computing a second projection matrix; and recovering the direction of camera translation using the shift data matrix, the reference image, the

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